HGB:AER

DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
WASHINGTON

Technical News Bulletin No. 42.

October 7, 1920.

GENERAL NOTE.

Owing to the current nature of the investigations mentioned in the Technical News Bulletin, sometimes it will be impossible to supply printed information regarding them. However, in these cases, when the investigation has progressed sufficiently far, the Bureau will be pleased to furnish technical data to those engaged in the particular application of the subject, in order to avoid the delay incident to publication.

--0--

1 Foreign Aviation Instruments

Several new instruments, most of them of German manufacture, have been received from the Bureau's representative in Europe, and have been studied carefully with the object of obtaining information concerning the future design of aeronautic instruments in this country. A Bamberg distant compass (A German instrument) has been thoroughly investigated and some very interesting results have been obtained. This compass depends for its operation upon the characteristic of selenium which causes a variation in its electrical resistance with any change in the intensity of illumination falling upon it. The installation is so arranged that the compass itself may be mounted in the tail of the airplane at a distance from all disturbing magnetic influences. The bowl of the compass contains two electric bulbs diametrically opposed which throw their rays through a lens which concentrates them upon two corresponding selenium cells mounted on a bridge extending across the top of the bowl. A metal disk, corresponding to the card of the ordinary compass, is cut in such shape that it acts as a blind for the illuminating elements. Thus the intensity of lighting

of the selenium cells is varied in accordance with the position of the magnetic element carrying this disk. By means of a properly arranged electric circuit, the position of the magnetic element is made known to the pilot by the indications of an ammeter suitably calibrated and mounted on the instrument board. The navigator is able to direct the pilot on a desired course by means of an indicator connected mechanically to the compass in such a manner as to make possible the rotation of the bowl at will by the navigator.

2 Index and List of Foreign Material Dealing With Aviation Instruments

The Bureau has spent considerable time in making a comprehensive index and list of material forwarded to this country by a member of the Aeronautic Instruments Section who was for some time in Europe. The object of the index is to render the material on hand more accessible and useful to interested persons outside the Bureau.

3 Recent Investigations in the Automotive Field

Some time ago, the Bureau commenced an investigation of the value of various systems of preheating the air-fuel mixtures used in automobile engines. A paper on this subject was presented at the June meeting of the Society of Automotive Engineers. Work has been continued and more complete data secured concerning the effect of different degrees of heating on engine economy, acceleration, etc. Several special fuels to be used in the airplane engine tests carried out in cooperation with McCook Field, have been analyzed as well as some blended fuels submitted for investigation by the Inventions Section of the War Department. Apparatus has been set up and test commenced to determine the performance of fan belts for the Motor Transport Corps. The apparatus consists of a motor driving a typical automobile cooling fan by means of a belt; the slippage can be determined by means of revolution counters attached to the motor and the fan pulley.

4 Specifications for Sextants

A set of specifications for sextants to be used by the Merchant Marine is ready for publication. These are to form the basis of certificates which will be issued for any such instruments submitted to the Bureau for test.

5 Calibration of Gas Recording Instruments

The calibration of 2 recording instruments for the determination of the purity of electrolytic oxygen by the thermal conductivity method has been completed. These instruments were built by the Leeds & Northrup Company for installation in an oxygen manufacturing plant. The Bureau is quite gratified to note that this type of recorder, which was designed by its Chemical Division, is finding application in the industries as well as within the Government service. Several manufacturers of chemical products have advised the Bureau of their intention of applying this method of analysis in several of their processes. The work of calibrating the 16-point gas analysis recorder for the helium plant at Fort Worth is well under way and the apparatus will probably be ready for installation during the next month.

6 Recent Chemical Publications

The following circulars from the Chemical Division of the Bureau have been issued during the past month:

Circular No. 97: Recommended Specifications for Green Paint, Semi-paste and Ready Mixed.

Circular No. 98: Recommended Specifications for Volatile Mineral Spirits for Thinning Paints.

7 Analysis of Samples of Ancient Armor

The analysis and microscopical examination of about one dozen samples of ancient armor from the Metropolital Museum of Art, New York, have been practically completed. The analysis indicates that all the samples were made from very pure wrought iron converted into steel by the old cementation process, as would be expected. The carbon determination was made on the entire cross-section as the material of all the pieces was too thin and corroded to obtain samples from different layers.

The microstructure indicates that the process used in the production of the original iron was very similar to our wrought iron process. The metal was then carbonized, probably by a supplementary process, hammered into sheets, differing in hardness (i.e. in the amount of carburization) and these sheets welded together. The whole was then hammered into shape and quenched, thus producing the final hardening effect.

8 Decarburization of Steel in Vacuum

A series of specimens of steels have been treated in vacuo at various temperatures (all above the lower transformation temperature, the A_1 point for different periods). As pointed out in a previous publication of the Bureau - Scientific Paper No. 356, the metal loses carbon on the surface, this loss being approximately proportional to the period of heating. The process of decarburization appears to be the inverse of carburization as usually carried out. In the latter method carbon penetrates the metal as carbon monoxide which later reacts with the iron to form an iron carbide and carbon dioxide which diffuses outward from the specimen. In the process of decarburization, the carbon evidently leaves the steel as a gas, probably carbon monoxide. This would necessitate the presence of oxygen in some form in the specimen which by a reaction with the carbide forms a gas which is later carried away by the action of the vacuum pump. The work is still uncompleted.

9 Exhibit at Convention of the American Steel Treaters' Society

The American Steel Treaters' Society held a Convention in Philadelphia during the week following September 14. The Bureau's exhibit, in connection with this Convention, consisted of a number of photographs, typical metallurgical specimens and apparatus to illustrate the work of its metallurgical division. The exhibit included such lines of metallurgical activity as magnetic testing, standard pyrometric samples, standard chemical samples, standard gage blocks, etc.

10 Work in Connection with National Plastering Code

In compliance with an insistent request from those interested in the plastering industry, the Bureau has undertaken to write a National Plastering Code. It is intended that this code shall contain specifications for all materials used in wall plaster, with complete directions for their use. Results of this work will eventually form the basis of a Bureau publication, which will be in such shape that it can be adopted verbatim by municipal and State legislative bodies, in the preparation of building codes.

The ground which it is proposed to cover has been divided for convenience into the following chapters: 1. Introduction; 2. Preparation for masonry surfaces, and specifications for lath; 3. Specifications for plastering materials; 4. Directions for the mixing and application of plaster; 5. Properties of the finished plaster; 6. Renovation and decoration; 7. Miscellaneous: suspended ceilings, corner beads, etc.

To assist the Bureau in this work, there has been called together a conference of representatives of the various industries involved. The personnel of this conference is such as to give established authority to its findings, and is as follows:

Materials' Manufacture.

Portland Cement Association, J. E. Freeman, Chicago; National Brick Manufacturers' Association, W. W. Griffiss, Baltimore; Hollow Tile Building Association, C. C. Crockatt, Chicago; Associated Metal Lath Manufacturers, Wharton Clay, Chicago; National Lumber Manufacturers' Association, R. S. Whiting, Chicago; Gypsum Industries Association, D. L. Haigh, New York, and V. G. Marani, Chicago; National Lime Association, L. H. Hart, Washington, and T. B. Shertzer, New York; National Association of Sand and Gravel Producers, E. G. Sutton, Indianapolis.

Users.

Contracting Plasterers International Association, J. J. Earley, Washington; Operative Plasterers and Cement Finishers International Association, J. M. Myles, Philadelphia; Wood, Wire and Metal Lathers International Union, W. J. McSorley, Cleveland.

Independent.

National Board of Fire Underwriters, I. H. Woolson, New York; Supervising Architect, U. S. Treasury Department, J. W. Ginder, Washington; American Institute of Architects, E. M. Donn, Jr., Washington, and D. K. Boyd, Philadelphia.

Bureau of Standards.

Cement and concrete, J. C. Pearson; Fire resistance, W. A. Hull; Acoustics, E. A. Eckhardt, Lime and gypsum, W. E. Emley, Chairman.

This conference was organized in January, 1920, and work has been steadily conducted by mail since that time. The first meeting, held at the Bureau on September 14, was called for a final discussion and criticism of chapters 1 and 2, which had previously been prepared and criticized by mail. Eleven members were present, and six more offered carefully prepared written communications. After a 12-hour session, all of chapter 1 and about three-fourths of chapter 2 were adopted.

11 Standardization of Sieves

During the month the problem of standardization of sand sieves has been taken up, with the object of preparing standard samples for their testing. The Bureau at present maintains standard cement samples for checking 200-mesh sieves and these samples may be used for the determination of correction factors for such sieves thus comparing them with the standards kept at the Bureau. The difficulty in preparing a sample for the standardization of sand sieves is due to the fact that it is almost impossible to secure a material that will remain uniform. In a relatively coarse sample, such as would be required in the testing of sand sieves, there is a tendency for the various sizes of grains or particles to segregate and not remain uniformly distributed. The problem is, therefore, to devise some method of preparing a series of samples that will have absolutely the same size gradation. It is hoped that the investigation will yield some valuable results along this line and that progress in its solution can be reported in the near future.

12 A Study of the Hardness of Glazes

An attempt is being made to differentiate the different glazes applied to clay products according to their hardness by tests similar to the Brinell test commonly used for metals. The hardened steel sphere used in the Brinell machine is replaced in this case by a conical steel point, the penetration of which into the glaze under high pressure, is an index of the hardness of the material. This penetration is measured by means of a micrometer microscope. The pressures employed for forcing the point into the glaze are quite high and have been as great as several hundred thousand pounds per square inch. Although the test has not yet been brought to a satisfactory status, it has differentiated between the several types of enamels and glazes examined, thus enamels are punctured under fairly low pressures while high-fire porcelain glazes are exceedingly resistant,- while white ware glazes occupy an intermediate position.

13 High-Fire Porcelain Glazes

This study has been completed and a final report prepared. It has been found that the range of compositions suitable for high-fire porcelain glazes increases rapidly with the temperature. The glazes of low silica content have been found to over-fire at the temperatures corresponding to Cone No. 12. The limits of suitable glazes for temperatures up to Cone No. 16 have been established quite definitely. The final report is now being edited and revised and it is hoped to publish it within a short time.

14 The Fish Scaling of Enamels

The study of seven ground coats in a series of twenty-one has been completed on seven different steels. The latter are comparatively high in copper and there appears to be no difference in the degree of fish scaling among the different samples thus far tested. These seven enamels are now being applied to low copper steels. One result of the investigation has been to show that less fish scaling occurs on lighter gage steels.

A second series of seven ground coats, high in quartz, is now being prepared and will be tested within the coming month. Arrangements have been made to try out on the commercial steel used by manufacturers the effect of a low copper content on fish scaling and if these results bear out the previous conclusions, a series of copper steels will be obtained for further investigation. The work will probably likewise include experiments with samples of steel which have been given various cold passes after enameling, and the effect of stretching the steel on a levelling machine will also be investigated.

15 Means for Increasing the Strength of Indian Pottery

Specimens of pottery made by the Hopi Indians are being fired to several temperatures to determine whether it is possible to increase the strength of these products without marring their appearance. As the ware is very fragile, it is frequently broken in shipment, and a means for increasing its strength is, therefore, highly desirable.

16 A Simple Portable Reflectometer

In Bulletin No. 35 there was mentioned a new type of reflectometer, suitable for measuring the reflection of light from walls, ceilings, and other objects which had been developed at the Bureau. Incidentally, measurements made with this instrument showed that there had been serious errors in the values previously accepted for the reflection factors of most materials. The development of this instrument and the publication of the values obtained with it stimulated considerable interest in this subject and a number of somewhat similar reflectometers have since been made up by other experimenters. All of the results obtained have corroborated those obtained at the Bureau.

The instrument then described depended upon computations which were somewhat complex and considerable precautions were necessary in its use in order to obtain correct values. In order to obviate these difficulties, a different type of instrument has been developed which

depends on the same fundamental principles as the original one but is more simple in operation. The new instrument will be described before the Convention of the Illuminating Engineering Society next month and the description will be published soon in the transactions of that Society, as well as in the scientific papers of the Bureau. The description of the original instrument has already been published as Scientific Paper No. 391 and also in the Journal of the Optical Society of America, Volume 4, No. 1, January, 1920.

17 A Method for Determining the Opacity of Eye-Protective Glasses to Ultra-Violet Rays

A quick method for determining the opacity of eye-protective glasses to ultra-violet rays has been worked out. The photographic method usually employed requires several hours for making such a test while by the new method, which is radiometric, a test can be made in a few minutes. The test is based upon the fact that all glasses are opaque to radiations of wave lengths less than 0.3 microns (1 micron = 1/1000 mm). It is, therefore, only necessary to examine eye-protective glasses for opacity to ultra-violet radiations of wave lengths 0.3 to 0.4 microns. Radiations of these wave lengths are easily obtained without employing a spectroscope by simply filtering the light from a quartz vapor lamp through a suitable glass screen placed over a vacuum thermopile. Measurements of one part in 10,000 are easily obtainable, whereas on the basis of the requirements of the proposed Safety Code for Head and Eye Protection, an accuracy of one part in 1,000 is all that is necessary.

18 Spectroscopic Analysis of Gold

Nine standard samples of gold alloyed with silver, copper, and iron have been examined spectroscopically to establish a method for making quantitative analyses of mint gold from spark spectra. As a result of this work, it appears that the common impurities of gold can be estimated in the range of 0.0001% to one or more per cent with a probable error of not greater than a few hundredths of one per cent.

19 Tests of Precision Weights

During the past month 987 weights were sent out upon completion of test, while 580 weights were received for test. The average for the last three months has been about 665 per month. In this connection, it is gratifying to note the recent improvement made by some makers in the accuracy of analytical weights. This was

clearly indicated in a recent shipment of 16 sets from one maker. In these sets every weight below 1 gram was within the required accuracy. The same shipment, unfortunately, showed a fault which is much too common in the larger weights, - this is a tendency for them to change in weight over a period of 3 or 4 months, even though not used at all, thus resulting in errors of some of the weights a trifle more than the tolerances. To avoid these errors, lacquered weights should be thoroughly dried and seasoned before the final adjustment, and lead, especially the use of small scraps, should be avoided, since it is likely to oxidize and cause the weights to gain. This trouble may probably be avoided by the use of aluminum, nickel, tin, or similar metals.

20 Calibration of End Standards by Interference Method

A great deal of interest has been shown in the interference methods employed by the Optical Division of the Bureau in the calibration of end standards used as precision gages. This method has proved rapid and reliable for work of this character and has greatly aided in the production of high precision end standards. An article on the calibration of precision gages by this method is at present being prepared for publication.

Respectfully,

S. W. STRATTON

Director

HGB